

Information Systems and Small Farm Development

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Working Paper 6/82

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## Introduction

Information systems are designed to help the decision processes in the administration of enterprises. Information systems can service both private and public undertakings at the firm, industry or national levels. The concern of information systems is primarily with practical problem solving. As the nature of the problem dictates the mode of inquiring used in arriving at a solution, the decision maker forms an integral part of the information system (Riemenscheider and Bonnen, 1979). In consequence, an information system designed to guide agricultural policy will differ significantly from one intended to assist farm managers. The underlying assumption behind the construction and implementation of information systems is that, as a general principle, better informed decisions lead to a reduction in net opportunity costs between action actually taken and that which would have been taken if knowledge had been perfect (Bernard 1979). Such benefits might arise by (Bisco 1970; Lee and Nicholson, 1973; Krauss, 1970):

1. Allowing problems to be studied in both greater depth and breadth and with greater predictive accuracy.
2. Allowing more timely analyses and decisions since data may be retrieved quickly and accurately from storage.
3. Avoiding wasteful duplication of expensive data collection exercises.
4. Improving the quality of data available. Computerised information systems are an established component in both private and public decision making. Private firms, parastatal bodies and government departments all use such information systems to guide policy and to examine alternative strategies. The growth of these systems is a function both of the rapidly increasing sophistication and computer technology and of the value of timely organised and accurate data for informed decision making. The costs of initial system development have, in the past, been high. Recent developments in computer together with accumulated experience in information system design technology have significantly reduced both the capital and the recurrent costs of implementing an information system. As a result, systems can feasibly and economically be designed for a much wider range of applications than was the case even a decade ago.

## The Nature of Data

Dunn writes "There is a pervasive tendency to assume that information is an intrinsic property of symbolic data" (Dunn, 1974). Information is not synonymous with data. While data collection, verification, storage and analysis are integral to the process of generating information, the data themselves do not equate to information. Reimenschneider and Bonner (1979) explained that:

"[A] data system is fundamentally an attempt to represent readily empirically. Since reality appears infinitely complex and is not readily grasped by the human mind, it is necessary first to break down experimental phenomena into a set of categories or classes that can be counted or measured. Counting or measuring is usually thought of in quantified terms but our arguments apply equally to numerical

and non-numerical data. Subjective impressions and simple relative comparisons, such as good or bad and high and low, can be treated in similar manner".

Data may already be in existence, or they may need to be collected. The changing nature of both societies and the problems they face have fundamental implications for data. Data may become obsolete if the concepts which they are intended to represent no longer adequately represent reality. The American Agricultural Economics Associations Economic Statistics Committee (1972) note that data obsolescence is a major source of data problems in agriculture. As an example, they cite the concept of the family farm around which much of the agricultural data in the United States have been centred over the past half century. The changing nature of the United States agricultural sector over this period has meant that the family farm is no longer as useful a concept on which to base data for agricultural policy.

Not all data pertinent to a particular subject may be used. Some of the data may be inaccessible or in a form which cannot be used for the problem at hand. In other cases, the data may not be relevant or they may serve to confuse or distract the decision-maker (Barnard, 1979). Again the variable nature of both problems and decision-making, will mean that data may shift between these categories over time. Data that are not relevant to one problem may be useful in solving another. Data may be made more accessible or conversely, become confidential to certain groups of decision-makers. However, it is in decision-making and problem solving that data have their value and it is for these ends that most data are collected and used. Before leaving the subject of data, it is appropriate to reflect on the issue of data quality, Barnard (1975) identifies three interlocking components which determine data quality :

(1) Accuracy :

Accuracy implies that the estimates of particular phenomena derived from the data are not significantly different from their true population parameters. The data, therefore, should reflect reality.

(2) Relevancy :

This implies that the data are appropriate for the purpose in hand. They should not be drawn from populations with different characteristics or whose nature has subsequently altered.

(3) Comprehensiveness :

This implies that the data include all the factors necessary for a satisfactory analysis of the problem at hand.

Data Requirements of Agricultural Policy

The collection of reliable data for agricultural policy is particularly fraught with problems. As Barnard (1979) writes :

" Since data are generated as observations and estimates of particular phenomena, they may fall in error because of lack of knowledge, disinterest, misunderstanding or deliberate distortion on the part of the estimator. These problems are exacerbated in agriculture because of the atomistic and spatial nature of the industry, the widely differing and varied resource endowment of farms - in both quantitative and qualitative terms - and because of the natural and biological foundations of production, in which dynamic elements arise in many of its

processes and there is considerable year-to-year variation in inputs and outputs".

Agricultural policy data are typically derived from sample surveys rather than experiments. These procedures may, in turn, give rise to further errors and biases deriving from unsuitable sampling techniques, inadequate sampling frames, poorly designed questionnaires and faulty enumeration (Barnard, 1979). For data to be of positive value in decision-making, their reliability must be established to the satisfaction of the decision makers.

In low-income economies, some 70 percent of the population are dependant upon agriculture. Between 60 and 70 percent of income is spent on food while both government and the non-agriculture sections rely heavily on the agricultural tax base (World Bank, 1982b.)

"One point emerges very clearly from the diversity of experience in developing countries : rapid growth in agriculture and in GDP go together. When the pursuit of industrialisation - the favoured target of planners in the 1950's and 1960's - has been successful, agricultural progress has not been sacrificed. Success in agriculture strengthens and helps sustain the whole economy" (World Bank, 1982b).

Some two-thirds of those countries listed as 'low-income' by the World Bank are on the African continent. The production of both food and export crops in Africa has stagnated over the past two decades. Rapidly rising populations in the region have meant per capita production has been declining and many of the rural poor face a real income loss. While the poor performance of African economies, and of agriculture, can be attributed to some extent, to exogenous factors, inappropriate domestic policies have played a major role. The World Bank identifies three critical domestic policy areas which impede Africa economic growth (World Bank, 1982a):

- (1) Trade and exchange-rate policies to protect industry at the expense of agriculture.
- (2) Administrative constraints in mobilizing and managing resources.
- (3) Consistent bias against agriculture in price, tax and exchange rate policies.

Agricultural information systems have the potential to provide policy-makers with relevant and current data on the agricultural industries. From such data, the strength and direction of responses to various policy measures can be estimated. The potential gains, therefore, from well-designed information systems that provide current, pertinent and accurate data are enormous.

#### The Nature of Information Systems

Data become information when they are analysed and interpreted in a manner useful for decision making. An information system, therefore, is a process which imposes form and gives meaning to data (Riemenschneider and Bonnen, 1979). It has three major components:

- (1) Data system : for collection verification and systematic storage of data.
- (2) Analytical capacity : to transform data into a format meaningful to the decision maker.
- (3) Decision makers : to interpret and act on the information produced.

Particularly in the agricultural context, where national policy makers typically work remote from the reality of farm management decision making, it is vital that all three components of the information system are closely integrated. Rarely will the decision-maker collect his own data; and it is usual for data collection to be the responsibility of low-echelon staff. The data therefore, need to be collected using concepts and terminology familiar to fairly unsophisticated farmers and enumerators. The information system must have the capacity to aggregate and interpret these data so that they are meaningful to planners. Critical decisions are the level of aggregation appropriate to the problem at hand and the method of formatting and communicating the information. Whenever the processes of data collection, data analysis and decision making are largely separate functions, the effectiveness of the information system in linking these components will define its usefulness.

A comprehensive review of information systems in agriculture has been provided by Blackie and Dent (1979). These range from single purpose systems for farm management applications to industry and national systems. The concern here is with information systems which link the policy maker with the realities of production at the small farm level. Eisgruber (1967) has observed that there is a considerable overlap in terms of basic data needs of different agricultural interests. It should, therefore, be possible to design a broadly-based information system that will serve the needs of, say, planners, extension agencies and marketing authorities. Plaunt (1967), took this argument further suggesting that the key issue was one of aggregation. Users at the farm management level, such as farming and extension agents, require relatively disaggregated data. Data would probably be required on a district or local government area basis. Marketing agencies and policy-makers require data aggregated on regional and national levels. The different users, however, have interests in the same basic data. The information system should, therefore, be based on as highly disaggregated data as possible but should have a very flexible capacity to aggregate and restructure data to make them appropriate to the different groups of users. An important corollary of this is that the data must be effectively identified, verified and coded (Plaunt, 1967).

#### Zimbabwe : A Case Study

With this background, it is now pertinent to examine the practical application of an agricultural information system in a developing country context. Zimbabwe has one of the strongest agricultural economies in the developing world. The nation is self-sufficient in food and has established itself as a major agricultural exporting nation. At independence the agricultural sector was well diversified which has helped the economy weather the continuing fluctuations in world prices of individual commodities. This productivity was, however, largely that of some 5000 large-scale farmers. Small scale farmers, particularly those in the communal lands or former native reserves, contributed only marginally to national marketed output (Blackie, 1982). This last group are the most numerous and the poorest in the country. Approximately 6 million small-scale farmers occupy some 50 percent of the land area of Zimbabwe - post-independence policy is intended to improve both their productivity and their welfare.

Statistics available at independence indicated that marketed output from the small-scale sub-section was about Z \$27 million as compared to Z \$587 million from large-scale farmers. The most important marketed commodities were cotton, groundnuts, maize and cattle. Non-marketed agricultural output was estimated at some Z \$64 million and income per capita was about Z \$23 (Miller, 1982).

Small scale farmers in the communal areas expended about 9 % of the total value of their production in the form of agricultural inputs. The corresponding figure in large scale farmers was in the order of 50%.

While the above data indicate the magnitudes and directions of differences between large-scale and small-scale agriculture in Zimbabwe, their accuracy was in some doubt. The enormity of the financial and physical problems facing the Zimbabwe government in rehabilitation of the small-scale sector required that a more accurate and timely system be devised to monitor small-farm performance. In co-operation with the Department of Land Management at the University of Zimbabwe, a pilot data collection exercise was set up. Out of this effort, it is envisaged that a national information system on small-scale agriculture will be implemented by the Ministry of Agriculture. A review of the literature indicated that Zimbabwe was not unique in its ignorance of the performance of small-scale farmers. Experience elsewhere indicated that the problem lay not only with the development of reliable data gathering techniques but also in the timely and meaningful processing of data. The Zimbabwe team, therefore, decided to tackle the problem of data processing and presentation simultaneously with that of data collection.

The volume of data to be collected and the requirement for flexibility in analysis and presentation, suggested that computer data storage and processing would be an essential component of the system. The team visited a variety of agencies holding software packages which potentially could be used in the Zimbabwe context. The final decision was to adopt the FARMAP suite of programmes which were, at that stage, being prepared for final release by FAO.

The FARMAP programmes have been designed for use in developing countries to facilitate computer analysis of farm survey data. The highly flexible nature of the programmes allows analysis of different farming systems, for example small-holder agriculture characterised by a fair degree of subsistence production, small-scale, labour-intensive commercial agriculture, and large scale capital intensive farming. These three categories of agriculture production are all relevant in Zimbabwe where the major thrust in rural development is improving the performance of the small scale commercial producers. The FARMAP system will be implemented initially in the small-scale sub-section with four main objectives.

- 1) The operation of FARMAP is intended to foster a close liaison between the extension officer and the farmer. The farmer will learn basic record-keeping and the speedy analysis of data. The simplicity of the system should alleviate the low ratio of extension workers to farmers which exists in most rural areas by improving the effectiveness of extension staff.

- 2) The establishment of a data bank on small-scale production

Data on the communal lands are few and of limited value FARMAP could help alleviate this problem. Timely and relevant information is vital in promoting accurate assessment of the needs of these areas, the constraints under which farmers operate, and the response of these farmers to various government policies such as price incentives.

- 3) The Monitoring of Resettlement Schemes.

This is essential to ensure that the successful implementation of these schemes. Careful monitoring coupled with the timely analysis of data will facilitate the smooth running of the schemes. The provision of further aid for resettlement is likely to be determined to some extent by the success of the schemes presently operational.

#### 4) National Planning Statistics.

The nationwide survey of the agricultural sector, coupled with the rapid retrieval and presentation of relevant statistics would be of great assistance to the planners and the policy makers.

The pilot scheme is being implemented together with a comprehensive training programme in the collection and analysis of farm survey data. A series of workshops are to be held at which the data and its presentation and relevance will be critically analysed. Concurrently the Ministry of Agriculture is systematically extending its survey capacity and progressively taking over those activities of the pilot scheme which have been adequately proven.

#### Post-script

Agricultural information systems, appropriately designed and implemented have considerable potential for enhancing development efforts in Third World countries. The evidence available suggests strongly that a vigorous agricultural sector is an essential component of development strategy in most such nations. Not only do the majority of people in low-income nations rely directly on agriculture for subsistence but it is the production from agriculture for subsistence but it is the production from agriculture that typically provides the resources for investment in both government and non-agriculture sectors of the economy.

Particularly in sub-Saharan Africa, agriculture has stagnated in recent years while world recession, climatic factors and other exogenous factors have played a part, poor domestic agricultural policies have exacerbated the situation. Information systems which link the policy makers more closely to the farmer, particularly the small-scale farmer, can be used to promote more sensitive and effective domestic agriculture policies than have been the normal in many low-income countries. Zimbabwe provides an illustration of how such a system may be implemented.

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